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(Materialy k obosnovaniyu predel'no dopustimoy kontsentratsii butifosa v vodoyemakh)

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DATA TO JUSTIFY THE MAXIMUM PERMISSIBLE CONCENTRATION OF BUTYPHOS IN RESERVOIRS

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Butyphos (tributyl-trithiophosphate) is a highly dynamic liquid of gray-yellow to brownish color with a very strong unpleasant odor. Boiling temperature is 151°, volatility 0.001 mg/l. The preparation is insoluble in water but easily dissolved in organic solvents and lipoids. It is produced commercially as an emulsion concentrate in OP-7 and dissolved in diesel fuel with a 70% effective start capacity. We used a 70% oil solution of butyphos in toxicologico-hygienic studies. All data were converted to a scale of 100%.

In the majority of cases, phosphororganic pesticides are standardized with regard to the organoleptic criterion and, therefore, this has been given special attention in establishing threshold concentrations.

Judging by the results of studies, threshold concentration of butyphos with regard to effect on odor with an intensity of 1 point is 0.009±0.00046 mg/l and with regard to effect on taste -0.0003±0.00013 mg/l. The concentration of the practical threshold of odor is 0.0152 ± 0.00063 mg/l, and of the practical threshold of taste - 0.00046 ± 0.0003 mg/l.

The stability of butyphos in water has been studied in model reservoirs where concentrations of the preparation of 0.3 and 3 mg/l were created. Dynamic determination of butyphos in the water of model reservoirs showed that it is a rather unstable substance. With an initial concentration of the preparation of 0.3 mg/l, therefore, it was not detected in the water of model reservoirs after 3 days and with a concentration of 3 mg/l it was completely broken down in the water of model reservoirs after 5 days.

In order to study the dynamic effect of butyphos on the sanitary regime of reservoirs , tests were made every 3-5 days for 20 days to determine the biochemical oxygen requirement (BOR), the amount of saprophyte microflora, the content of dissolved oxygen and ammonification and nitrification processes in water. With a concentration of butyphos of 0.03 mg/l, BOR of the sample during the observation period barely differed from the control. Butyphos in a concentration of 0.3 mg/l caused BOR to increase 10-12% by the end of the test ($P<0.05$). With a concentration of 3 mg/l BOR increased 35% ($P<0.05$). Therefore, the threshold concentration of butyphos with regard to its effect on BOR is 0.3 mg/l.

With a butyphos concentration of 0.3 mg/l, the content of saprophyte microflora in the water of model reservoirs did not differ from the control. The preparation in amounts of 0.3 and 3 mg/l caused an insignificant increase in the amount of saprophyte microflora.

None of the tested concentrations of butyphos had any significant effect on mineralization of the water in model reservoirs. Threshold concentration of butyphos with regard to effect on the sanitary regime of reservoirs is 0.3 mg/l.

To ascertain the toxicity of the material to different kinds of laboratory animals we ran tests on white mice, rats, guinea pigs and rabbits with a single injection of the preparation into the gastro-intestinal tract. Most sensitive to butyphos were the guinea pigs. LD_{50} for them was 140 (120-160) mg/kg; LD_{50} for white mice was 179 (158-200) mg/kg, for white rats 217 (164-270)mg/kg and for rabbits 242 (216-268) mg/kg. Butyphos has a strong resorptive-toxic effect. The dermal-oral coefficient (LD_{50} to skin 97.5 mg/kg, LD_{50} intraintestinally 242 mg/kg) for rabbits is 0.4. The locally stimulating effect of the preparation on the skin and mucous membrane of the eyes is weak.

In studying the cumulative properties of butyphos by means of a single injection into the gastro-intestinal tract, it was shown that the defoliant has weak cumulative properties and its effect depends on the divisibility of the injected dose. Thus, with the injection of the drug into the stomach of rats in a dose of $^1/_5$ LD_{50}(43.4 mg/kg) 4 out of 6 rats died in 7-10 days, having received from 2.6 to 18.4 LD_{50}. By the end of the test (120th day) 2 rats survived, each having received 20.8 LD_{50}. The coefficient of cumulation is 15.4. Rats which received butyphos in a dose of $^1/_{10}$ (21.7 mg/kg) and $^1/_{20}$ (10.8 mg/kg) LD_{50} survived for 4 months after a total administration of 10.4 and 5.2 LD_{50}.

In an experiment on animals, the activity of cholinesterase in the blood (serum and erythrocytes) was also determined. In addition, several biochemical indices characterizing the function of the liver were studied. In rats which had received butyphos in doses of $^1/_{10}$ LD_{50}, by the end of the 1st month of the test the excretion of hippuric acid in urine increased 20% ($P<0.05$) and the activity of cholinesterase in whole blood was depressed 70% ($P<0.05$). On the 120th day of the study, in test animals against a background of severe depression of cholinesterase (80%), a reduction of 52% was noted in the excretion of hippuric acid. In animals given doses of $^1/_{20}$ LD_{50} of butyphos on the 30th and 50th days of the test the level of excretion of hippuric acid did not differ from the control, but the activity of cholinesterase in the blood was depressed 34-64% ($P<0.05$). On the 120th day of the test, excretion of hippuric acid in the urine of test animals was decreased 49% ($P<0.05$). The reduced excretion of hippuric acid in urine is evidently connected with the development of toxic hepatitis under the influence of butyphos. It has been established that with a prolonged effect of butyphos on the body of

animals most pronounced are changes in the protein-formation function of the liver. This is indicated by the increased turbidity of the thymol test 40-50% ($P<0.05$) and shifts to the right in the Weltmann reaction.

A study of the carbohydrate function of the liver revealed an 18-24% reduction in the sugar content ($P<0.05$). After 4-month peroral administration of butyphos, a galactose load test was made. The resultant sugar curve made it possible to trace the assimilation of galactose by liver cells. In test animals, a high level of sugar was noted in the blood for 4 hours after a load of galactose. In animals in the control group the sugar curve was the usual kind.

Peroral administration of butyphos to animals in doses of $^1/_{10}$ and $^1/_{20}$ LD_{50} caused a reliable increase (25-30%) in the activity of glutamic-alaninic transaminase (ALT). The activity of glutamic-asparaginic transaminase (AST) was reduced to a lesser degree , i.e. 15-18%. Therefore, the ratio of AST to ALT (deRitis coefficient) was below 1. Typical of toxic hepatitis is increased ALT activity and reduction of the deRitis coefficient below 1. It must be assumed that the increased activity of transaminase in blood serum which we observed with the single introduction of butyphos was due to the uptake of these enzymes from necrotic epithelial cells.

Taking into account the weak cumulative properties of butyphos and the large gap between the threshold dose of chronic toxicological experiment and the threshold concentration according to the effect of the preparation on the taste of water (about 1,000,000 times), the maximum permissible concentration of the substance in reservoirs can be assumed to be 0.0003 mg/l with regard to the organoleptic index of harmfulness.